(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
29 March 2001 (29.03.2001)

PCT

(10) International Publication Number
WO 01/21994 A2

(51) International Patent Classification[7]: F16L

(21) International Application Number: PCT/US00/26076

(22) International Filing Date:
22 September 2000 (22.09.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/400,954 22 September 1999 (22.09.1999) US

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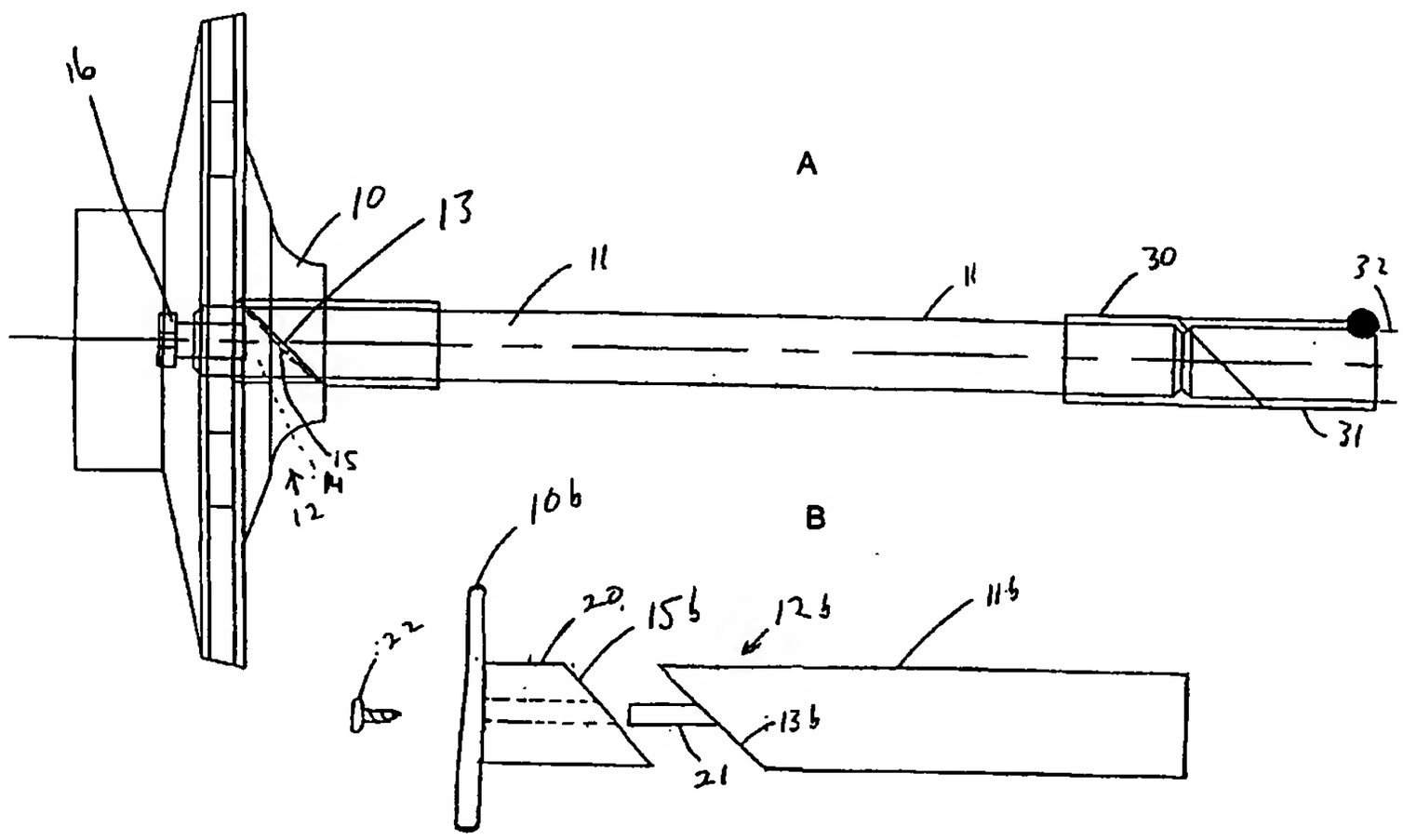
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *Without international search report and to be republished upon receipt of that report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: ANGLED END COUPLER



(57) Abstract: A coupling system for a rotary arrangement. The coupling system includes a shaft that has a proximal end that includes an angled face. The system also includes a coupler that includes an angled face configured for engagement with the angled face of the shaft. The coupler is coupled or attached to a rotary element such that upon coupling of the rotary element to the shaft via the coupler, the rotary element will rotate with the shaft as opposed to relative thereto.

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ANGLED END COUPLER

BACKGROUND OF THE INVENTION

1. Field Of The Invention

The present invention relates to a coupler and more particularly, to a coupling system for a rotary arrangement wherein the coupling system includes mating, angled faces.

2. Description Of The Prior Art

Propellers, impellers, and other rotating devices are often of two piece construction connecting a hub to a shaft, two shafts together, etc. When connecting the various components, one component may "slip" relative to another component. For example, a hub including impeller blades may slip or rotate relative to the input shaft.

Previously, a slot was defined within the shaft and the hub. The hub was then placed over the shaft such that the slots were aligned and a key was placed within the aligned slots. This generally prevented the hub from rotating relative to the shaft. However, such an arrangement is time consuming and adds expense to the manufacture of the components.

SUMMARY OF THE INVENTION

In accordance with one embodiment of the present invention, a coupling system for a rotary arrangement includes a shaft that includes a distal end and a proximal end. The distal end is configured for coupling to an input source and the proximal end includes an angled face. The coupling system further includes a coupler coupled to a rotary element that includes an angled face configured for mating engagement with the angled face of the shaft.

In accordance with one aspect of the present invention, the proximal end of the shaft includes a threaded bore for receiving a screw.

In accordance with a further aspect of the present invention, each of the angled faces is at an angle of substantially 45° with respect to an axis defined by the shaft.

In accordance with another embodiment of the present invention, a rotary arrangement includes a shaft wherein a distal end of the shaft is configured for coupling to an input source and a proximal end of the shaft includes an angled face. The rotary arrangement further includes a coupler that includes an angled face configured for mating engagement with the angled face of the shaft. A rotary element is coupled to the shaft with the coupler.

In accordance with another embodiment of the present invention, a coupler includes a first sleeve including an angled face and a second sleeve including an angled face configured for mating engagement with the angled face of the first sleeve.

In accordance with one aspect of the present invention, each sleeve includes bores for receiving screws to compress the sleeves.

Other features and advantages of the present invention will be understood upon reading and understanding the detailed description of the preferred exemplary embodiments, found hereinbelow, in conjunction with reference to the drawings, in which like numerals represent like elements.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1A is a side elevation view of a rotating element coupled to a shaft in accordance with the present invention;

Figure 1B is a side elevation view of an alternative embodiment of a rotating element coupled to a shaft in accordance with the present invention; and

Figure 2 is a side elevation view of two shafts coupled together with an angled coupler in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EXEMPLARY EMBODIMENTS

Figure 1A illustrates a hub 10 that may represent an impeller blade, a propeller blade, or other rotary element. A shaft 11 is provided that is coupled, either directly or indirectly, to an input source (not shown) for providing rotary motion to hub 10 to thereby rotate the hub.

In accordance with the present invention, a proximal end 12 of the shaft includes an angled face 13. Angled face 13 may be defined on shaft 11 so that the outer surface of the shaft is continuous or smooth as shown in Figure 1B, for example, by machining the angled face on shaft 11. Alternatively, a sleeve may be placed over the

end of the shaft that includes an angled face as shown in Figure 1A. Such a sleeve would be coupled to shaft 11 by, for example, welding, interference with screws, or the like.

Hub 10 includes an angled female pocket 14 that has an angled face 15 that mates with angled face 13 of the shaft when the proximal end of the shaft is inserted therein. Preferably, the shaft includes a threaded bore defined in its proximal end 12 for receiving a screw 16 to securely attach or couple the shaft to the hub. However, other ways known in the art may be used to attach or couple the shaft to the hub.

Accordingly, shaft 11 and hub 10 are coupled together in such a manner that when the shaft rotates, the hub will also rotate without rotating relative to the shaft due to the mating of the angled faces due to the interference provided by the mating, angled surfaces.

In a preferred embodiment, the angled faces are substantially 45° with respect to a longitudinal axis defined by the shaft. However, other angles may be used to provide the interference to prevent relative rotation therebetween.

Figure 1B illustrates an embodiment where hub 10b includes a short shaft 20 that terminates in an angled face 15b. Shaft 11b, at its proximal end 12b, includes an angled face 13b with a minor shaft 21 extending coaxially therefrom. Short shaft 20 of hub 10b is placed over minor shaft 21 of shaft 11b so that the angled faces engage and mate. The hub and the shaft are then attached or coupled together to prevent separation in a manner known in the art. In an preferred embodiment, minor shaft 21 includes a threaded bore defined therein for receiving a screw or bolt 22 to attach the hub thereto.

Figure 1A also illustrates two end angled coupler sleeves 30, 31 in accordance with the present invention that are used to couple two separate shafts 11, 32 and hold them in place. The sleeves are slipped over ends of the shafts and then brought together so that their angled faces engage and mate. The sleeves are coupled to their respective shafts by, for example, welding, interference fit, screws, or the like. The shafts are held in place at their distal ends by, for example, roller bearings within rotation pockets. The shafts are supported at their distal ends to prevent separation at sleeves 30, 31 when the shafts are horizontal.

Figure 2 illustrates two end angled coupler sleeves 40, 41 similar to those illustrated in Figure 1A. The sleeves include bores 42 for receiving screws, pins, or the like that then compress the sleeves around the shaft. Such an embodiment is useful for

preventing axial thrust from separating the two shafts. Once again, the angled faces would be engaged and mated and attached by weld adhesive or an interference fit.

Although the invention has been described with reference to specific exemplary embodiments, it will be appreciated that it is intended to cover all modifications and equivalents within the scope of the appended claims.

WHAT IS CLAIMED IS:

1. A coupling system for a rotary arrangement, the coupling system comprising:

a. a shaft including a distal end and a proximal end, the distal end being configured for coupling to an input source and the proximal end including an angled face coupled thereto; and

b. a coupler coupled to a rotary element, the coupler including an angled face configured for mating engagement with the angled face of the shaft.

2. A coupling system in accordance with claim 1 wherein the proximal end includes a threaded bore for receiving a screw.

3. A coupling system in accordance with claim 1 wherein each of the angled faces is at an angle of substantially 45° with respect to an axis defined by the shaft.

4. A coupling system in accordance with claim 1 wherein the angled face at the proximal end of the shaft is defined thereon.

5. A coupling system in accordance with claim 1 wherein the angled face is defined on a coupling element that is coupled to the shaft.

6. A rotary arrangement comprising:

a. a shaft including a distal end and a proximal end, the distal end being configured for coupling to an input source and the proximal end including an angled face coupled thereto;

b. a rotary head coupled to the shaft with the coupler; and

c. a coupler coupled to a rotary element, the coupler including an angled face configured for mating engagement with the angled face of the shaft.

7. A rotary element in accordance with claim 4 wherein the proximal end includes a threaded bore for receiving a screw.

8. A rotary element in accordance with claim 4 wherein each of the angled faces is at an angle of substantially 45° with respect to an axis defined by the shaft.

9. A coupling system in accordance with claim 4 wherein the angled face at the proximal end of the shaft is defined thereon.

10. A coupling system in accordance with claim 4 wherein the angled face is defined on a coupling element that is coupled to the shaft.

11. A coupler comprising:

a. a first sleeve including an angled face; and

b. a second sleeve including an angled face configured for mating engagement with the angled face of the first sleeve.

12. A coupler in accordance with claim 7 wherein each sleeve includes bores for receiving screws to compress the sleeves.

13. A coupler in accordance with claim 7 wherein each of the angled faces is at an angle of substantially 45° with respect to an axis defined by the shaft.

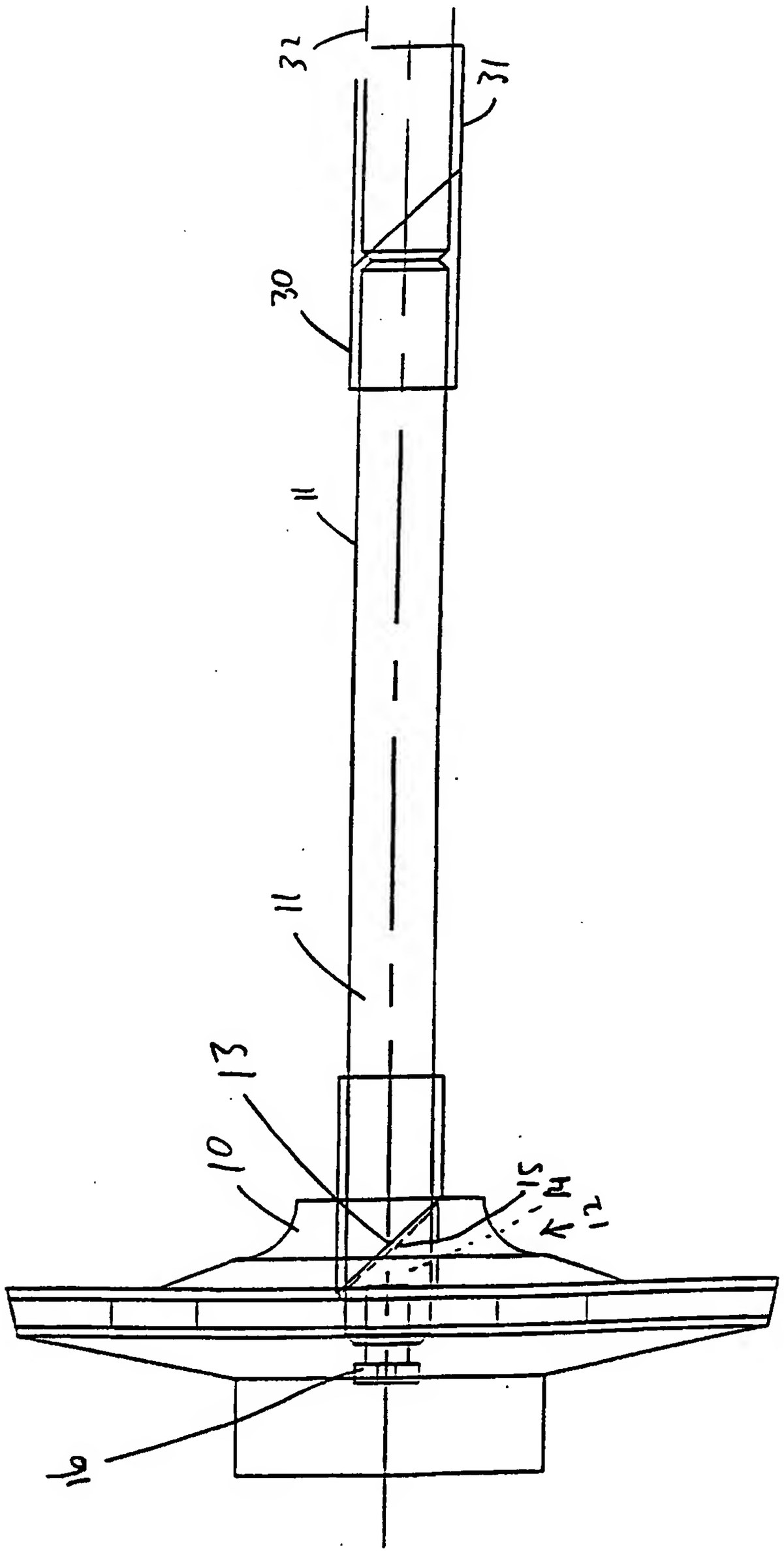

Figure 1A

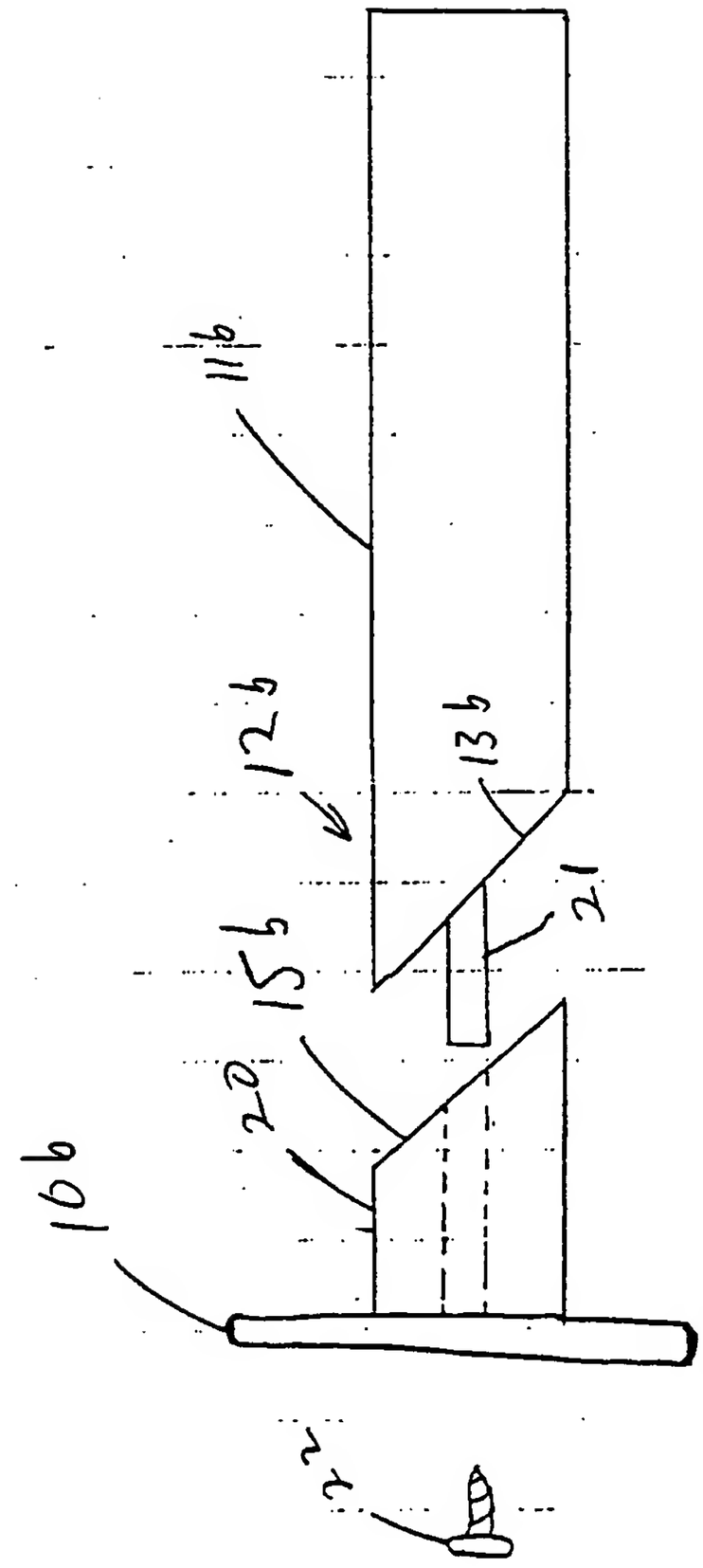

Figure 1B

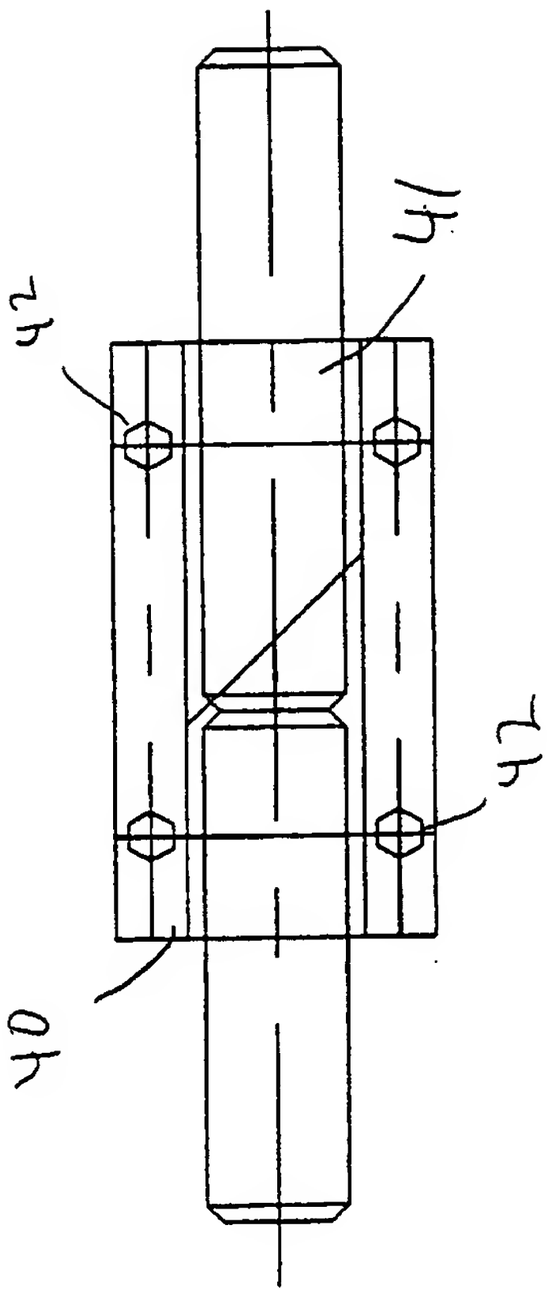

Figure 2